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### F. S. HOLBROOK

It is with deep regret that the National Bureau of Standards announces the death of Fay S. Holbrook on February 4, 1940, following an attack of coronary thrombosis. Mr. Holbrook was born in Albany, N. Y., January 8, 1887. He attended Cornell University, was graduated with honors from Georgetown University Law School, and was a member of the bar of the District of Columbia. He joined the staff of the National Bureau of Standards, as assistant physicist, in 1909, and became chief of the Division of Weights and Measures in 1921.

His legal knowledge eminently fitted Mr. Holbrook to handle many important phases of the Bureau's work, not confined to his special field of weights and measures. In this special field he was preeminent, being recognized throughout the country as an authority in matters relating to the technical and administrative aspects of weights and measures supervision. For many years he was secretary of the National Conference on Weights and Measures, in which capacity he was able to render most effective

service in promoting standardization among weights and measures regulatory agencies of the States and cities through cooperative effort and coordination of Federal and State activity, and in encouraging the extension of this character of service in all parts of the United States. Some years ago Mr. Holbrook was called upon to establish the system of weights and measures control which has since been operative in Puerto Rico. A field investigation in which he took an active part shortly after becoming a member of the Bureau staff was largely responsible for the enactment in many States of laws establishing departments of weights and measures.

Outstanding among his activities at the Bureau of Standards have been Mr. Holbrook's close association with and direction of an investigation of railway track scales, carried on since 1914, and more recently a program of vehicle-scale testing conducted in cooperation with the several States.

Mr. Holbrook suffered a severe heart attack a year and a half ago, but he shortly returned to duty. His death came suddenly, following a final illness of only 4 days.

<sup>1</sup> Published with the approval of the Director of the Budget.

### MEETING OF NATIONAL CONCRETE MASONRY ASSOCIATION

The annual meeting of the National Concrete Masonry Association was held in Washington February 12-14, 1940. The afternoon of February 12 was devoted to a session at the Bureau and to an inspection of the fire-resistance laboratory where a test of a concrete masonry wall was in progress.

Dr. Lyman J. Briggs, Director of the Bureau, welcomed the 300 delegates and guests, and pointed out the value of research as a means for bettering any given product. He stressed the fact that if an existing product can be improved so that more ways can be found for its utilization, not only will the industry concerned with that product be protecting itself against advances made in competing materials, but a basic contribution will have been made to American industry.

Four papers were presented by members of the Bureau's staff: Loads on building walls and the strength of concrete masonry walls, by A. H. Stang; Water permeability of concrete masonry walls, by D. E. Parsons; Paints for exterior finishing of concrete masonry walls, by Clara Sentel; and Fire resistive dwelling construction of masonry, by S. H. Ingberg.

### PERFORMANCE TEST OF FLOOR COVERINGS

In an effort to determine within a comparatively short time the relative ability of various types of floor coverings and various methods of installation to withstand hard and prolonged service, a performance test, necessarily somewhat severe, has been conducted in the Bureau's floor-testing chamber. This work formed part of the research program on building materials suitable for low-cost house construction. As explained in the complete account of these experiments, published as Building Materials and Structures Report BMS34, uncontrolled variations in many important factors, such as quality of materials used, condition of subfloors, methods of installation, and extent of abuses, make direct comparisons of floor coverings in service a difficult matter.

The floor-testing chamber contains a circular track 4 ft wide and approximately 40 ft in diameter, in which are installed wood or concrete subfloors and the various floor coverings and adhesives for test. In the performance test, a platform truck equipped with steel wheels was propelled around the track

by a "walking wheel" 4 ft. in diameter. The walking wheel was shod with leather during the first half of the test and with abrasive cloth during the second half. The floor coverings tested included several kinds of linoleum, felt-base floor coverings having various wearing surfaces, pressed fiberboard, and three strip wood floors. The bonding agents used included lignin pastes, resinous cements, casein-latex cement, asphaltic cements, and nails.

The results of the performance test have been judged principally by the general appearance of the installations at the end of the test, after 48,000 cycles of the testing equipment. Representative photographs of the different floor coverings at the end of the test are shown.

In the selection of a floor covering and bonding agent, the nature of the service to which they will be subjected and their cost should be considered along with the desires of the user with respect to specific properties. Some of the lower cost floor coverings and methods of bonding, even though less durable, may render economical and satisfactory service, provided they are not subjected to abuse, and only moderate length of service is required, or where frequent replacements may be desirable, such as in rental dwellings. When durable floor coverings are used over wood subfloors under severe traffic conditions, an underlay of asphalt-saturated lining felt is recommended from the standpoint of indentation and durability. Where less durable floor coverings are used and occasional reinstallations are probable, dry lining felt in conjunction with lignin paste over wood subfloors is desirable, unless other adequate means are provided for removal.

Copies of BMS34 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

### STRUCTURAL PROPERTIES OF WOOD-FRAME BUILDING CONSTRUCTIONS USING "RED STRIPE" LATH

Tests were recently completed on 30 specimens submitted by the Weston Paper and Manufacturing Co., representing conventional wood-frame wall, partition, floor, and roof constructions using a paper-stock lath marketed under the trade name "Red Stripe."

The wall specimens were subjected to compressive, transverse, concentrated, impact, and racking loads; the partition specimens to concentrated and impact loads; the floor specimens to transverse,

concentrated, and impact loads; and the roof specimens to transverse and concentrated loads. For each of the loads three like specimens were tested. The transverse, concentrated, and impact loads were applied to both faces of wall specimens, and for these loads six like specimens were tested. The deformation under load and the set after the load was removed were measured for uniform increments of load, except for concentrated loads, for which the set only was determined. The results, presented graphically and in tables, are given in Building Materials and Structures Report BMS36, which has just been released. The price is 10 cents a copy. Send orders to the Superintendent of Documents, Government Printing Office, Washington, D. C.

#### EFFECT OF HEATING AND COOLING OF PERMEABILITY OF MASONRY WALLS

Since the coefficients of thermal expansion of masonry units and mortars are unequal, changes in temperature may cause cracks in the mortar joints of masonry walls, through which water can leak during a wind-driven rain.

Permeability tests have been made at the Bureau on eleven small masonry wall specimens before and after exposing them to a number of cycles of heating and cooling. Seven of the specimens were 12-in. brick walls, two were of clay tile with stucco facings, and two were brick walls with hollow-unit backings. The walls were dry when subjected to extremes of temperature over a range of about 105° F. The maximum air temperature was about 125° F. and the minimum less than 20° F. For each cycle, the walls were stored in the heating or cooling rooms until they attained room temperature. The results indicate that repeated exposure of dry walls to extremes of temperature does not have an important effect on the permeability of all-brick walls.

The complete account of this work has just been published as Building Materials and Structures Report BMS41. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

#### ELECTRICAL PROPERTIES OF MARBLE

In the Journal of Research for March (RP1281), Arnold H. Scott describes a determination of the dielectric constant, power factor, and resistivity of marble

from Vermont, Alabama, and Georgia. Measurements were made when the marble was dry, and after it had been stored for over a month in an atmosphere having a relative humidity of 85 percent. The effect of frequency on the dielectric constant and power factor was also studied. It was found that the electrical properties of marble may vary widely but that the colored marbles have higher dielectric constants and power factors than the white marbles.

#### MEASUREMENT OF GAMMA RADIATION FROM RADIUM BY THE FREE AIR IONIZATION CHAMBER

X-rays generated by 1,000,000 volts are now commonly used in medical treatment, and it has become necessary to extend the standards of X-ray dosage from the older limits at 400,000 volts to the newer million-volt region. To this end, a 1,500,000-volt X-ray generator will be installed in the new laboratory which is nearing completion at the Bureau. As a preliminary to the use of the new equipment, it has been necessary to explore further the possibilities of the present X-ray dosage standards. One-half gram of radium was borrowed from the National Cancer Institute, to serve as a source of radiation having a penetration and quality comparable to that from 1,500,000-volt X-rays. Measurements with this radium proved the adequacy of the Bureau's standards for such measurements, and in fact, established for the first time the relationship between the international units of X-ray dosage and gamma-ray dosage. Million-volt X-rays and the gamma rays from radium are somewhat similar in their medical usefulness, but it has been impossible up to the present adequately to compare the two, and to decide the relative economics of the two modes of treatment. With the newly established relationship between their respective units of dosage, which is fully discussed in a paper (RP1283) by Lauriston S. Taylor and George Singer in the March Journal of Research, it is believed that the range of usefulness of each will be extended.

#### BOILING POINTS OF HEPTANE AND ISOCTANE

Precise pressure-temperature relationships of certain pure substances are needed for such purposes as the calculation of the number of theoretical plates required in a fractionating column to obtain desired separations,

the reduction of certain calorimetric data, and the use of boiling points in specifications of purity.

By a comparative dynamic method, using water as the reference standard and ebulliometers of the Swietoslawski type, Edgar Reynolds Smith has obtained data from which the following equations have been developed to express the relationship between temperature and vapor pressure from 100 to 1,500 mm:

For *n*-heptane,

$$\log_{10} p = 6.905113 - \frac{1269.821}{217.110 + t}$$

For 2,2,4-trimethylpentane,

$$\log_{10} p = 6.820137 - \frac{1262.707}{221.307 + t}$$

In these equations, *p* is the vapor pressure in standard millimeters of mercury exerted by the substance at the temperature *t* in degrees centigrade.

The complete report of this work will be published as RP1280 in the Journal of Research for March.

#### COMBINATION OF WOOL PROTEIN WITH ACID AND BASE

The protein material of which wool is principally composed possesses a variety of chemical groups capable of combining with acids and bases. The state of combination of these groups is intimately related to the ability of wool to absorb moisture and dyes, its elastic and tensile properties, and its behavior in carbonizing, scouring, and milling. In order to form a background for studies of these technologically significant properties of wool, a series of investigations on the acidic and basic properties of the fibers has been undertaken by Jacinto Steinhardt and Milton Harris, research associates at the National Bureau of Standards, representing the Textile Foundation.

The present study is concerned with the description of the relation between amounts of hydrochloric acid and potassium hydroxide bound by wool, and the concentration of these substances in solution. The effect of the presence of added neutral salt, potassium chloride, on this relation has also been studied. Although the maximum amounts of acid or base bound are independent of the presence or absence of salt, the way in which this maximum is approached depends very greatly on the presence of salt, and varies with the amount present. Thus the range of concentrations of acid in which the amount of acid bound increases from zero to near its maximum value is relatively narrow when salt is absent. Since this is also

true of combination with base, there is a wide region in the middle of the acid-base scale in which no combination with either can be detected. In the presence of even small concentrations of salt, the course of combination is more gradual, and the point at which no combination with either acid or base occurs is sharply defined. The higher the concentration of salt present, the lower is the concentration of acid or base at which any given amount of either is combined. This dependence is so marked that, in dilute solutions, doubling or tripling the concentration of salt has practically the same effect as doubling or tripling the concentration of acid or base. In the Journal of Research for March (RP1286), it is shown that all these effects of salt are manifestations of the same restriction; the fiber must combine with or adsorb equivalent quantities of both positive and negative ions. Thus, its ability to combine with hydrogen ions is limited by the simultaneous availability of chloride ions. By interpreting the combination with these accessory ions in terms of the partial dissociation of protein salts formed by combination with acid or base, the details of the difference between the curves of combination in the absence of added salt and in the presence of different concentrations of added salt are fully explained. This interpretation also leads to the prediction that the data of acid combination obtained in the presence of high concentrations of salt should correspond very closely with the results that would be obtained if wool could be studied in the dissolved state. By comparing the data obtained for wool with data for a soluble protein, egg albumin, which contains the same proportion of different acidic groups, this prediction is verified. On the basis of this comparison and by analogy with similar work on other soluble proteins, the curves relating the amount of acid combined to degree of acidity are resolved into component parts which are consistent with previously published figures for the amino-acid composition of the fiber.

The demonstration that the combination of anions with the fiber is a limiting factor in the combination with acid may prove to be significant in the process of acid dyeing. In this process, competition between the colored dye anions and the simple anions of the commonly used Glauber's salt may play a part.

#### SECOND IONIZATION CONSTANT FOR MALONIC ACID

Solutions which resist a change in hydrogen-ion activity on dilution or on

the addition to the solution of a small amount of acid or alkali are called buffer solutions. Solutions having this property are suited for use in control of reactions which require an optimum pH range and for other purposes where the pH of the medium must be accurately known or controlled. These solutions are also well suited for the establishment of reference points on the pH scale or for calibration of this scale.

Solutions of dibasic acids and their salts usually have high buffer capacity. Only qualitative data are available on the buffer capacity and pH values of malonic acid and its salts. Both of these quantities are related to the ionization constants which define the dissociation of malonic acid into its ions and to which definite numerical values may be assigned. All dibasic acids dissociate in two steps and hence have two ionization constants which define the equilibria of the two steps.

As described in the March Journal of Research (RP1284), Walter J. Hamer, John O. Burton, and S. F. Acree recently made accurate determinations of the values of the ionization constant for the second step in the dissociation of malonic acid at 0° to 60° C. The values were determined from measurements of the emf of galvanic cells without liquid junction and containing various molalities of sodium acid malonate, sodium malonate, and sodium chloride. Measurements were made with high accuracy by the procedure described in J. Research NBS 23, 647 (December 1939) RP1261.

Measurements were made at 5° intervals from 0° to 60° C. The pH values of the solutions investigated ranged from 5.272 at 0° C. to 5.761 at 60° C. and were obtained with an accuracy of 6 parts in 10,000, or 0.06 percent. The solutions were less acidic at the higher temperatures. From measurements of the hydrogen-ion activity, of the ionization constant, and of the effect of temperature upon these quantities, the change in free energy, the heat of ionization, and the changes in the entropy, and specific heats for the ionization of malonic acid were calculated. These thermodynamic quantities are of importance in arriving at explanations for the variation of hydrogen-ion activity with temperature.

#### REDUCING POWERS OF SUGARS

In the Journal of Research for March (RP1282), Horace S. Isbell, William W. Pigman, and Harriet L. Frush describe a modification of Scales' method for the determination of reducing sugars. The boiling time was increased, and reducing

values of 32 sugars were determined at various concentrations. The method as modified provides a simple, convenient means for the quantitative determination of the rare sugars. A comparison of the reducing values of different sugars reveals that the configurations of carbons 3, 4, and 5 have marked effect on the reducing values, but that the configuration of carbon 2 has little influence. Sugars in which the hydroxyl on carbon 3 is *trans* to the hydroxyls on carbons 4 and 5 give the highest reducing powers, while those which have *cis* hydroxyls on carbons 3 and 4 give lower reducing values. When the glycosidic union of a disaccharide is on carbon 3, the molecular reducing power is less than that of the monosaccharide corresponding to the reducing part of the molecule; if the glycosidic union is on carbon 4, the molecular reducing power is about 1.4 that of the corresponding monosaccharide, and if on carbon 6, the molecular reducing power is about 1.2 that of the corresponding monosaccharide. The effect of barium bromide on the reducing powers of the sugars varies with the experimental conditions. Under the conditions used in this investigation the presence of 6.5 percent of barium bromide lowers the reducing value by approximately 4 percent.

#### SILVER-LINED BARRELS AND CANS

Methods suitable for producing silver-lined barrels and cans are outlined in a paper to be published in the Journal of the American Electrochemical Society. This describes the results of research work at the Bureau by the American Silver Producers' Research Project staff. The paper, entitled "Research on Industrial Silver Plating", by A. J. Dornblatt, A. C. Simon, A. M. Setapen, G. J. LeBrasse, and J. T. Lumley, discusses the production of pore-free silver deposits, the application of commercial forming operations to the manufacture of silver-lined containers by deep drawing operations, and the assembly of silver-lined barrels and fittings by silver brazing.

#### SURFACE COLORS

A normal observer sees objects in nearly their daylight colors even when the illuminant departs quite markedly from average daylight. The processes by which he adapts himself to the illuminant or by means of which he discounts most of the effect of a nondaylight illuminant are complicated; they are known to be partly retinal and partly cortical.

In the Journal of Research for March (RP1285), Deane B. Judd has made a general formulation of these changes, by means of which it is possible to compute approximately the hue, saturation, and lightness of a surface color from the tristimulus specifications of the light reflected from the surface, and of the light reflected from the background against which it is viewed. This formulation has been tested by six observers viewing 150 sample-illuminant-background combinations comprising 15 samples, 5 widely different illuminants, and 2 backgrounds.

### MATHEMATICAL TABLES

A series of about 10 publications containing mathematical tables is being prepared, under the sponsorship of the Bureau, as part of program of the Work Projects Administration. Two of these publications, bearing the following titles, are now available:

Tables of the first ten powers of the integers from 1 to 1000.

Tables of the exponential function  $e^x$ . In any scientific or technical research, these should prove valuable for reference purposes. The editions are limited, but the Bureau has been able to place copies in the leading Government depository libraries.

Those desiring the tables for personal use may purchase them as long as the supply lasts, at 50 cents for "the first ten powers," and \$2.50 for "the exponential function." In the case of copies to be sent abroad, 15 cents and 50 cents, respectively, should be added to these prices.

Checks should be made payable to the National Bureau of Standards and sent with order to the Information Section, National Bureau of Standards, Washington, D. C. Copies cannot be sent collect or on approval.

### NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1940

#### Journal of Research<sup>2</sup>

Journal of Research of the National Bureau of Standards, volume 24,

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$3.50 per year (to addresses in the United States and its possessions, and in countries extending the franking privilege); other countries, 70 cents and \$4.50, respectively.

number 2, February 1940 (RP1273 to RP1279, inclusive). Price 30 cents, Annual subscription, 12 issues, \$3.50.

#### Research Papers<sup>3</sup>

[Reprint from the November 1939 Journal of Research]

RP1254. Cosmic-ray observations in the stratosphere with high-speed counters. Leon F. Curtiss, Allen V. Astin, Leroy L. Stockmann, and Burrell W. Brown. Price, 10 cents.

#### Simplified Practice Recommendations<sup>2</sup>

R143-39. Paper cones and tubes (for textile winding). (Supersedes R143-35.) Price, 5 cents

#### Building Materials and Structures<sup>3</sup>

[Persons who wish to be notified of new publications in the Building Materials and Structures series as soon as they are available, should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

BMS34. Performance test of floor coverings for use in low-cost housing: Part 1. Percy A. Sigler and Elmer A. Koerner. Price, 10 cents.

BMS36. Structural properties of wood-frame wall, partition, floor, and roof constructions with "Red Stripe" lath sponsored by The Weston Paper and Manufacturing Co. Herbert L. Whittemore and Ambrose H. Stang with the collaboration of Thomas R. C. Wilson, Forest Products Laboratory. Price, 10 cents.

BMS41. Effect of heating and cooling on the permeability of masonry walls. Cyrus C. Fishburn and Perry H. Peterson. Price, 10 cents.

#### Technical News Bulletin<sup>2</sup>

Technical News Bulletin 274, February 1940. Price, 5 cents. Annual subscription, 50 cents.

### RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS<sup>3</sup>

Carbon dioxide fire tests. Quar. Nat. Fire Protection Assn. (60 Battery-march St., Boston, Mass.) 33, 275 (January 1940).

Report of tests with carbon dioxide as an extinguishing medium for fires in

<sup>3</sup> These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.



- buildings. Mimeographed circular, Federal Fire Council (S. H. Ingberg, National Bureau of Standards, Washington, D. C.) (January 1940).
- Hue, saturation, and lightness of surface colors in chromatic illumination. Deane B. Judd. *J. Opt. Soc. Am.* (Cornell University, Ithaca, N. Y.) **30**, 2 (January 1940).
- Methods and results of ozone measurements over Mount Evans, Colo. R. Stair and I. F. Hand. *Monthly Weather Rev.* (U. S. Weather Bureau, Washington, D. C.) **67**, 331 (September 1939).
- Behavior of rubber hydrocarbon in a molecular still. W. H. Smith and H. J. Wing. *Rubber Chemistry and Technology* (1500 Greenmount Ave., Baltimore, Md.) **12**, 789 (October 1939).
- Permeability of neoprene to gases. T. P. Sager and M. Sucher. *Rubber Chemistry and Technology* **12**, 875 (October 1939).
- Principles, practice, and progress of noise reduction in airplanes. Albert London. *Nat. Advis. Com. Aero. Tech. Note No. 748* (National Advisory Committee for Aeronautics, Washington, D. C.) (January 1940).
- Moisture content of thrown silk effected by threads and twist. E. Max Schenke and Howard E. Shearer. *Southern Knitter* (218 W. Morehead St., Charlotte, N. C.) **4**, 12 (January 1940), and *Underwear and Hosiery Rev.* (93 Worth St., New York, N. Y.) **23**, 103 (January 1940).
- Determination of uronic acids in cellulosic materials. Roy L. Whistler, Albert R. Martin, and Milton Harris. *Textile Research* (65 Franklin St., Boston, Mass.) **10**, 109 (January 1940), *Am. Dyestuff Reporter* (440 Fourth Ave., New York, N. Y.) **29**, 1 way, Pa) **35**, 5 (January 1940).
- Influence of natural non-tannins on the deterioration of chestnut and quebracho leathers by sulfuric acid. Roy C. Bowker and Robert B. Hobbs. *J. Am. Leather Chemists Assn.* (Ridgway, Pa.) **35**, 5 (January 1940).
- Computing titration blanks. Francis W. Glaze. *Ind. Eng. Chem. (Analytical ed.)*, (Mills Building, Washington, D. C.) **12**, 14 (January 15, 1940).
- Finding ferns. C. E. Waters. *Am. Fern J.* (N. Queen St. & McGovern Ave., Lancaster, Pa.) **29**, 125 (October-December 1939).





